

Office Action Summary	Application No. 10/526,489	Applicant(s) KITAHARA, YASUHISA	
	Examiner Loren C. Edwards	Art Unit 3748	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 4/13/07.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 2-36 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 2-36 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 March 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 4/13/07 has been entered.

2. An Applicant's Amendment filed on 4/13/07 has been entered. Claim 1 has been canceled; claims 2, 7, 30, and 32 have been amended; and claims 35 and 36 been added. Overall, claims 2-36 are pending in the application.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) The invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 2-4, 7, 8, 10-13, 17, 18, 27-30, and 35 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Salvat et al. (U.S. 6,412,276). Salvat discloses a combustion control apparatus for an internal combustion engine, comprising: an exhaust purifier (Fig. 1, No. 8) in an exhaust passage of the internal combustion engine; a combustion controlling actuator to cause main combustion (Col. 3, Lines 1-7), and to cause preliminary combustion (Col. 3, Lines 12-20) prior to the

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main combustion; and a controller (Fig. 1, No. 7) to control fuel injection to produce the preliminary combustion, and to control fuel injection to start the main combustion after an end of the preliminary combustion (Fig. 3; Col. 3, Lines 1-20); wherein the combustion controlling actuator includes a fuel injector (Fig. 1, No. 6) to inject fuel directly into a combustion chamber of the engine; and the controller is configured to perform a preliminary fuel injection (Fig. 3) to produce the preliminary combustion at or near top dead center (Col. 3, Lines 1-29), and to perform a main fuel injection (Fig. 3, No. 13) to start the main combustion after the preliminary combustion is finished such that a premixed combustion process is predominant in the main combustion (Fig. 3).

5. With regards to claim 3, Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to control the combustion controlling actuator in a split combustion mode (Fig. 3) by controlling the fuel injection to produce the preliminary combustion at or near top dead center, and by controlling the fuel injection to start the main combustion after the end of the preliminary combustion when a split combustion request is produced to bring the exhaust purifier to an operative state (Col. 2, Line 61 – Col. 3, Line 20).

6. With regards to claim 4, Salvat discloses the combustion control apparatus of claim 3, as described above, and further wherein the controller is configured to control the combustion controlling actuator normally in a normal combustion mode (Fig. 2), and to change over a combustion control mode from the normal combustion mode to the split combustion (Fig. 3) mode in response to the split combustion request produced in accordance with a condition of the exhaust purifier (Col. 2, Lines 47-67).

7. With regards to claim 7, Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to delay the start of the main combustion (Fig. 3).

8. With regards to claim 8, Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to perform the main fuel injection for the main combustion at a timing to start the main combustion after an end of a heat releasing process of the preliminary combustion (Col. 3, Lines 1-20).

9. With regards to claim 10, Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to control a preliminary fuel injection quantity of the preliminary fuel injection to a smaller quantity required to increase an incylinder temperature in the combustion chamber, and to make a main fuel injection quantity of the main combustion greater than the preliminary fuel injection quantity, to produce engine torque with the main combustion (Col. 3, Lines 1-20).

10. With regards to claim 11, Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to control a preliminary fuel injection quantity for the preliminary fuel injection equal to a fuel quantity required to make an incylinder temperature in the combustion chamber at a fuel injection timing of the main combustion, higher than or equal to an auto ignition temperature enabling spontaneous ignition in the combustion chamber (Col. 2, Lines 61-67).

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11. With regards to claim 12, Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein an amount of retard of a combustion start timing of the main combustion with respect to a combustion start timing of the preliminary combustion is equal to or greater than 20° in crank angle (Col. 3, Lines 20-29).

12. With regards to claim 13, Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein an amount of retard of a combustion end timing of the main combustion with respect to compression top dead center is equal to or greater than 50° in crank angle (Col. 3, Lines 20-29).

13. With regards to claim 17, Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to control an exhaust gas temperature of the engine by varying the fuel injection timing of the main combustion (Fig. 2; Fig. 3; Col. 3, Line 1-29).

14. With regards to claim 18, Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to control the main combustion so as to hold torque produced by the engine constant (Col. 2, Lines 51-55).

15. With regards to claim 27, Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to perform a plurality of preliminary fuel injections to cause a plurality of heat releasing processes for the preliminary combustion prior to the main combustion so that at least one of the

heat realizing processes of the preliminary combustion is produces at or near top dead center (Col. 3, Lines 1-29).

16. With regards to claim 28, Salvat discloses the combustion control apparatus of claim 27, as described above, and further wherein the controller is configured to perform a plurality of preliminary fuel injections to cause a plurality of heat releasing processes for the preliminary combustion in a low engine load region (Col. 3, Lines 1-29).

17. With regards to claim 29, Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the combustion control apparatus further comprises the internal combustion engine which is a diesel engine (Abstract).

18. With regards to claim 30, Salvat discloses a combustion control process for an internal combustion engine provided with an exhaust purifier in an exhaust passage of the internal combustion engine, the combustion control process comprising: controlling the fuel injection to produce preliminary combustion in an engine cycle (Fig. 3; Col. 3, Lines 1-20) by performing a preliminary fuel injection to produce the preliminary combustion at or near top dead center (Col. 3, Lines 20-29); and controlling fuel injection to start main combustion after an end of the preliminary combustion in the engine cycle (Fig. 3; Col. 3, Lines 1-20) such that a premixed combustion process is predominant in the main combustion (Fig. 3).

19. With regards to claim 35, Salvat discloses the combustion control process of claim 30, as described above, and further wherein the start of the main combustion is delayed with respect to the preliminary combustion (Fig. 3).

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20. Claims 30, 32-34, and 36 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Tashiro et al. (U.S. 6,901,747). Ito discloses a combustion control process for an internal combustion engine (Fig. 9, E) provided with an exhaust purifier (Fig. 9, No. 3) in an exhaust passage of the internal combustion engine, the combustion control process comprising: controlling fuel injection to produce preliminary combustion (Fig. 1a) in an engine cycle by performing a preliminary fuel injection (Fig. 1a, Tp) to produce the preliminary combustion at or near top dead center (Col. 4, Lines 3-11); and controlling fuel injection to start main combustion after an end of the preliminary combustion in the engine cycle (Fig. 1a) such that a premixed combustion process is predominant in the main combustion (Fig. 1).

21. With regards to claim 32, Tashiro discloses a combustion control apparatus for an internal combustion engine, comprising: means for determining an estimated condition of an exhaust purifier in an exhaust passage of the internal combustion engine (Fig. 11); means for producing a split combustion request in accordance with the estimated condition of the exhaust purifier (Fig. 1; Fig. 11, Steps 22 and 23); and means for controlling fuel injection to the engine in a split combustion mode in response to the split combustion request by controlling fuel injection to produce preliminary combustion and controlling fuel injection to start main combustion after an end of the preliminary combustion (Fig. 1) such that a premixed combustion process is predominant in the main combustion (Fig. 1), the means for controlling the fuel injection including means for performing the preliminary injection at such a timing as to cause a heat releasing

process of the preliminary combustion to start before compression top dead center and to end after compression top dead center (Fig. 1a; Col. 4, Lines 3-11).

22. With regards to claim 33, Tashiro discloses the combustion control process of claim 30, as described above, and further wherein the preliminary fuel injection for the preliminary combustion is performed during a compression stroke (Fig. 1a).

23. With regards to claim 34, Tashiro discloses the combustion control process of claim 30, as described above, and further wherein the preliminary fuel injection is performed at such a timing as to cause a heat releasing process of the preliminary combustion to start before a compression top dead center and to end after the compression top dead center (Fig. 1a; Col. 4, Lines 3-11).

24. With regards to claim 36, Tashiro discloses the combustion control apparatus of claim 32, as described above, and further wherein the means for controlling the fuel injection to the engine in the split combustion mode includes means for decreasing a percentage of diffusive combustion in the main combustion and instead increasing a percentage of premixed combustion in the main combustion by delaying a start of the main combustion after the end of the preliminary combustion (Fig. 1).

Claim Rejections - 35 USC § 103

25. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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26. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

27. Claims 5, 6, 19, and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Salvat in view of Kamiya et al. (U.S. 4,685,290). Salvat discloses the combustion control apparatus of claim 4, but fails to specifically describe wherein the controller is configured to estimate a condition of the exhaust purifier. Kamiya discloses an engine control with the function to eliminate minute particles in the exhaust gas that estimates the amount of particulate trapped in a filter and uses this to trigger the regeneration of the filter (Kamiya; Abstract). It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the exhaust purifier condition estimator as taught by Kamiya in the system of Salvat for the advantage of efficient regeneration.

28. With regards to claim 6, the modified Salvat discloses the combustion control apparatus of claim 5, as described above, and further wherein the combustion control apparatus comprises a condition sensor (Kamiya; Fig. 2, No. 23) to collect information needed to determine the estimated condition of the exhaust purifying section.

29. With regards to claim 19, the modified Salvat discloses the combustion control apparatus of claim 3, as described above, and further wherein the exhaust purifier

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includes a particulate filter (Salvat; Fig. 1, No. 8) to collect exhaust particulate matter, and the controller is configured to produce the split combustion request (Salvat; Col. 2, Lines 61-67) in accordance with an estimated particulate matter quantity (Kamiya; Abstract) of the particulate matter accumulated in the particulate filter, to increase an exhaust gas temperature for auto oxidation of the particulate matter in the particulate filter.

30. With regards to claim 31, the modified Salvat discloses the combustion control process of claim 30, as described above, and further including: determining an estimated condition of the exhaust purifier (Kamiya; Abstract); producing a split combustion request in accordance with the estimated condition of the exhaust purifier (Salvat; Col. 2, Lines 61-67); changeover a combustion control mode from a normal mode to a split combustion mode in response to the split combustion request (Salvat; Col. 2, Lines 47-67); and controlling the fuel injection to produce the preliminary combustion and the fuel injection to start the main combustion after the end of the preliminary combustion in the split combustion mode (Salvat; Figs. 3 and 4).

31. Claims 9, 14-16, 20, 21, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Salvat in view of Sasaki et al. (U.S. 6,804,952). With regards to claim 20, Salvat discloses the combustion control apparatus of claim 3, as described above, but fails to specifically describe the exhaust purifier including a NOx trap catalyst device. Sasaki discloses a catalyst warm up control for diesel engines that uses a NOx trap catalyst (Sasaki; Col. 4, Lines 4-20) in an exhaust track to reduce NOx emissions, and further uses a split injection technique to rapidly warm this catalyst to operating

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temperature (Sasaki; Col. 2, Lines 18-33). It would have been obvious to one having ordinary skill in the art at the time the invention was made to utilize the NOx trap catalyst of Sasaki in the system of Salvat for the advantage of reducing NOx emissions.

32. With regards to claim 21, the modified Salvat discloses the control apparatus of claim 20, as described above, and further wherein the controller is configured to produce the split combustion request in accordance with an estimated NOx quantity of the NOx trapped in the NOx trap device (Sasaki; Col. 6, Lines 37-48; Salvat; Col. 2, Line 61 – Col. 3, Line 7).

33. With regards to claim 26, the modified Salvat discloses the combustion control apparatus of claim 3, as described above, and further wherein the exhaust purifier includes an NOx trap catalyst device (Sasaki; Col. 4, Lines 4-20) to trap NOx in a lean operation of the engine, and the controller is configured to produce the split combustion request at a time to warm up the NOx trap device (Sasaki; Col. 2, Lines 18-34).

34. With regards to claim 9, the modified Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to start the main fuel injection for the main combustion at a timing to inject fuel in a state in which flame subsided in the combustion chamber, to prevent diffusive combustion process in the main combustion (Sasaki; Figs. 7A and 7B).

35. With regards to claim 14, the modified Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to perform a preliminary fuel injection for the preliminary combustion during a compression stroke (Sasaki; Col. 8, Line 66 – Col. 9, Line 10).

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36. With regards to claim 15, the modified Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to perform the preliminary injection at such a timing as to cause a heat releasing process of the preliminary combustion to start before compression top dead center and to end after compression top dead center (Sasaki; Col. 8, Line 66 – Col. 9, Line 10).

37. With regards to claim 16, the modified Salvat discloses the combustion control apparatus of claim 2, as described above, and further wherein the controller is configured to vary at least one of a fuel injection quantity and a fuel injection timing of the preliminary fuel injection for the preliminary combustion in accordance with a compression end temperature in the combustion chamber at an end of a compression stroke (Sasaki; Col. 8, Line 66 – Col. 9, Line 10; Col. 9, Line 52 – Col. 10, Line 2).

38. Claims 22-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Salvat in view of Kitahara (U.S. 6,796,118). With regard to claim 23, Salvat discloses the combustion control apparatus of claim 3, as described above, but fails to specifically disclose the exhaust purifier including an NOx trap device or a controller configured to produce a split combustion when the NOx trap needs to be purged of sulfur. Kitahara discloses an exhaust gas purification system and method for an internal combustion engine that disposes a NOx trap in an exhaust track (Kitahara; Fig. 1, No. 13) and performs a split injection when the trap is in a state of sulfur poisoning (Kitahara; Col. 4, Lines 10-38). It would have been obvious to one having ordinary skill in the art at the

time the invention was made to utilize the NOx trap of Kitahara in the system of Salvat for the advantage of reducing NOx emissions.

39. With regards to claim 24, the modified Salvat discloses the combustion control apparatus of claim 23, as described above, and further wherein the controller is configured to produce the split combustion request in accordance with an estimated sulfur content quantity of the sulfur content trapped in the NOx trap device (Kitahara; Col. 4, Lines 10-38; Fig. 2, Step 4).

40. With regards to claims 22 and 25, the modified Salvat discloses the combustion control apparatus of claims 20 and 23, as described above, and further wherein the controller is configured to produce the split combustion request in accordance with a distance traveled by a vehicle powered by the internal combustion engine (Kitahara; Col. 4, Line 57 – Col. 5, Line 6).

Response to Arguments

41. Applicant's arguments filed 4/13/07 have been fully considered but they are not persuasive. Applicant has argued that the Salvat and Tashiro systems fail to teach starting a main combustion after a preliminary combustion. The examiner respectfully disagrees. In each of Salvat and Tashiro there are multiple pre injections that cause combustions. Looking at Figure 3 of Salvat, I'1 represents pre-combustion which concludes when combustion I'2 starts. If the flame of I'1 had not yet extinguished at the start of I'2, then all of that flame then merges with and becomes I'2. The main combustion, I'3, follows I'2. By this interpretation, combustion I'1 has finished at the

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start of combustion I'3, and therefor Salvat reads on the claimed invention. A similar interpretation of Tashiro is also argued with respect to Figures 1-B and 1-C of Tashiro.

Conclusion


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Loren C. Edwards whose telephone number is (571) 272-2756. The examiner can normally be reached on M-TH 5:30-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thomas Denion can be reached on (571) 272-4859. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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